We claim:

1. A process for preparing oligomers consisting mainly of repeating units derived from 1- or 2-butene from a hydrocarbon stream consisting substantially of branched and linear hydrocarbon compounds having 4 carbon atoms, and comprising olefinic branched and linear hydrocarbon compounds having 4 carbon atoms (C_4 starting stream) by

   a. in step a), separating the C_4 starting stream into a fraction consisting mainly of linear hydrocarbon compounds having 4 carbon atoms (l-C_4 fraction) and a fraction consisting mainly of branched hydrocarbon compounds having 4 carbon atoms (b-C_4 fraction), by contacting the C_4 starting stream with a membrane which is easier to pass for linear hydrocarbon compounds having 4 carbon atoms than for branched carbon compounds having 4 carbon atoms,

   b. in step b), optionally after removing butanes, oligomerizing the olefinic hydrocarbon compounds having 4 carbon atoms present in the l-C_4 fraction,

   c. in step c), subjecting the olefinic hydrocarbon compounds having 4 carbon atoms present in the b-C_4 fraction to one of the following steps:

      c1. reaction with methanol to give methyl tert-butyl ether (step c1)

      c2. hydroformylation to give substantially isovaleraldehyde (step c2)

      c3. polymerization to polyisobutylene (step c3)

      c4. dimerization to 2,4,4-trimethyl-1-pentene (step c4)

      c5. alkylation, substantially to form saturated hydrocarbon compounds having 8 or 9 carbon atoms (step c5).

2. A process as claimed in claim 1, wherein the membrane used in step a) is made of inorganic material having molecular sieve properties.

3. A process as claimed in claim 1 or 2, wherein the membrane used in step a) consists at least partly of zeolites of the MFI type.

4. A process as claimed in any of claims 1 to 3, wherein the separation in step a) is carried

out in such a way that the C_4 starting stream in liquid or gaseous form is contacted with the membrane and the I-C_4 fraction passing the membrane is removed in gaseous form, and the pressure on the side of the membrane on which the C_4 starting stream is disposed is greater than the pressure on the side of the I-C_4 fraction.

5. A process as claimed in any of claims 1 to 4, wherein the C_4 starting stream used consists substantially of

- from 30 to 99% by weight of olefinic branched and linear hydrocarbon compounds having 4 carbon atoms
- optionally from 1 to 70% by weight of saturated branched and linear hydrocarbon compounds having 4 carbon atoms
- optionally up to 50% by weight of any other unsaturated hydrocarbon compounds having 4 carbon atoms
- optionally from 0 to 50% by weight of any hydrocarbon compounds having less than 4 or more than 4 carbon atoms.

6. A process as claimed in claim 5, wherein the C_4 starting stream is prepared by carrying out the following sequence of steps:

- removing a C_4 hydrocarbon fraction (C4 stream) from a hydrocarbon stream from natural sources or obtainable by subjecting naphtha or other mixtures which consist essentially of hydrocarbons to a steam cracking or FCC process,
- preparing a C_4 hydrocarbon stream consisting substantially of isobutene, 1-butene, 2-butene and butanes (raffinate I) from C4 stream by hydrogenating the butadienes and butynes to C_4-alkenes or C_4–alkanes by means of selective hydrogenation or removing the butadienes and butynes by extractive distillation,
- freeing raffinate I of catalyst poisons by treating with adsorbent materials and in this way obtaining C_4 starting stream.

7. A process as claimed in any of claims 1 to 6, wherein, in step b, the I-C_4 fraction is converted mainly to octenes and dodecenes over a nickel catalyst.

8. A process as claimed in any of claims 1 to 7, wherein, in step b, the removal of butanes is effected distillatively.

9. A process as claimed in claim 7, wherein the octenes or dodecenes are converted to nonanol or tridecanol by hydroformylation and subsequent hydrogenation.